# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **ROBINSON POND** the program coordinators recommend the following actions.

Welcome to the New Hampshire Volunteer Lake Assessment Program! As you continue your participation in VLAP the database you create for your water body will help you track trends in lake quality and identify potential problems. As a rule of thumb, try to sample once per month during the summer. Other special sampling programs include monitoring for non-point sources of pollution to the lake, and more frequent, long-term sample collection to establish a complex data set of your lake's water quality. We understand that future sampling will depend upon volunteer availability, water monitoring goals, and funding. **Trend analysis is not feasible with only a few data points.** It can take a few years of data collection to obtain an adequate set of baseline data. Frequent and consistent sampling will ensure useful data for future analyses. Contact the VLAP Coordinator this spring to schedule our annual lake visit. If your group feels they need a refresher in sampling techniques, call us early to make an appointment. Please consult the Interpreting Data and Monitoring Parameters sections of this report when trying to understand data.

#### FIGURE INTERPRETATION

Figure 1: These graphs illustrate concentrations of chlorophyll-a, also a measure of algal abundance, in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The current year data (the top graph) show an increasing inlake chlorophyll-a trend throughout the summer. abundant alga in July and August was the filamentous blue-green When Oscillatoria becomes abundant bright green clumps can form on the lake surface. Blue-green algae are indicative of culturally eutrophying lakes (see the Interpreting Data section of this report). The average chlorophyll-a concentration for the lake exceeds the state mean. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the

- education process and keep residents aware of the sources of phosphorus and how it influences lake quality.
- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The upper graph shows a *stable* trend in lake transparency during the summer of 2000. The clarity was not significantly affected by the abundance of blue-green algae in July or August. Algae can form blooms only in small portions of the Pond or wind may blow blooms to the shore. The average transparency in Robinson Pond was slightly below the state average. The 2000 sampling season was considered to be wet and, therefore, average transparency is expected to be slightly lower. We will be able to discern changes in clarity once more data is collected in the years ahead. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.
- > Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stable* trend for this summer's epilimnetic phosphorus levels, and slightly increasing hypolimnetic levels as the summer progressed. There was a large spike in the total phosphorus reading in August, which was accompanied by high turbidity. We believe the sample was contaminated with sediment. Please be careful when gathering the hypolimnetic sample; be sure there is no sediment in the bottle. You can avoid getting sediment in the sample by taking the hypolimnetic sample last or on the opposite end of the boat from the anchor. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

#### **OTHER COMMENTS**

- Exotic fanwort and variable milfoil were discovered in Robinson Pond this year. Both plants were found ringing most of the shallow areas of the Pond. We will continue to map and monitor changes in plant density and recommend appropriate management practices.
- ➤ Conductivity for the in-lake samples and surrounding tributaries were for the most part fairly low (Table 6). The highest recorded

- conductivity this summer was found at Station 2 and the highest average conductivity was at Station 1. We will watch these tributaries in the future in order to determine the causes and to reduce the pollutants entering the lake from them. Conductivity increases often indicate the influence of human activities on surface waters. Septic system leachate, agricultural runoff, iron deposits, and road runoff can each influence conductivity readings.
- In 2000, large amounts of the blue-green algae *Oscillatoria* and smaller amounts of *Anabaena, Coelosphaerium, and Microcystis* were observed in the plankton sample (Table 2). Blue-green algae can become nuisance species when sufficient nutrients and favorable environmental conditions are present. Overall, algal abundance in the lake is very abundant and the presence of these indicator species should serve as a reminder of the lake's delicate balance. Continued care to protect the watershed by limiting or eliminating fertilizer use on lawns, keeping the lake shoreline natural, and properly maintaining septic systems and roads will keep algae populations in balance.
- ➤ We recommend that the volunteers collect stormwater samples in the future. These samples would help us to determine sources of nutrients and pollutants to the water at times of high flow. The spring of 2001 would be an appropriate time to undertake this project. For more information on conducting this type of sampling please contact the VLAP Coordinator at (603) 271-2658.
- Dissolved oxygen was very low in the hypolimnion throughout the summer (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of thermally stratified lakes. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be released into the water column, a process that is referred to as *internal loading*. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.
- ➤ *E. coli* levels in the Pond this year were all within the state's standards for surface waters of less than 406 counts per 100 mL (Table 12). *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations were all very low at the sites tested. If residents are concerned about septic system impacts, testing when the water table is high or after a rain event is best.

#### **NOTES**

- ➤ Monitor's Note (6/9/00): Water fowl (herons, merganser); found exotic fanwort.
- ➤ Biologist's Note (6/9/00): Internal loading in hypolimnion.

#### **USEFUL RESOURCES**

Stormwater Management and Erosion and Sediment Control Handbook. NHDES, Rockingham County Conservation District, USDA Natural Resource Conservation Service, 1992. (603) 772-4385.

Lake Eutrophication, WD-BB-3, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or <a href="https://www.nhlakes.org">www.nhlakes.org</a>

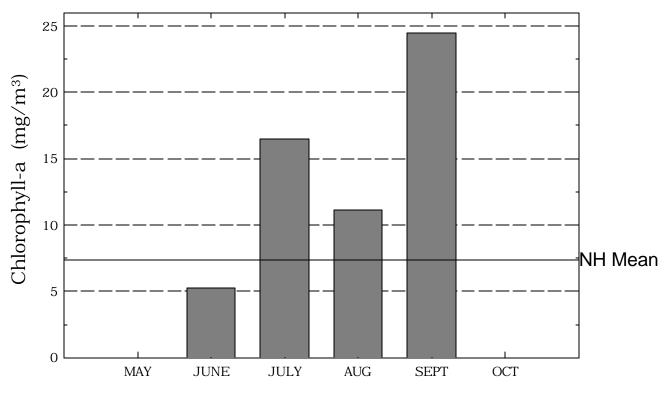
Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

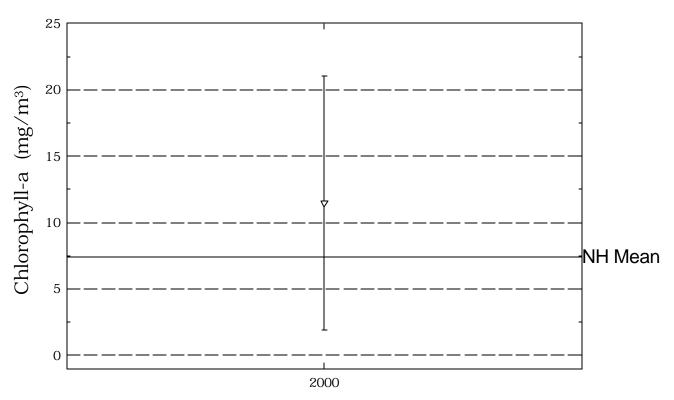
Through the Looking Glass: A Field Guide to Aquatic Plants. North American Lake Management Society, 1988. (608) 233-2836 or www.nalms.org

## Robinson Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



2000 Chlorophyll-a Results



Historical Chlorophyll-a Results

## Robinson Pond

Figure 2. Monthly and Historical Transparency Results

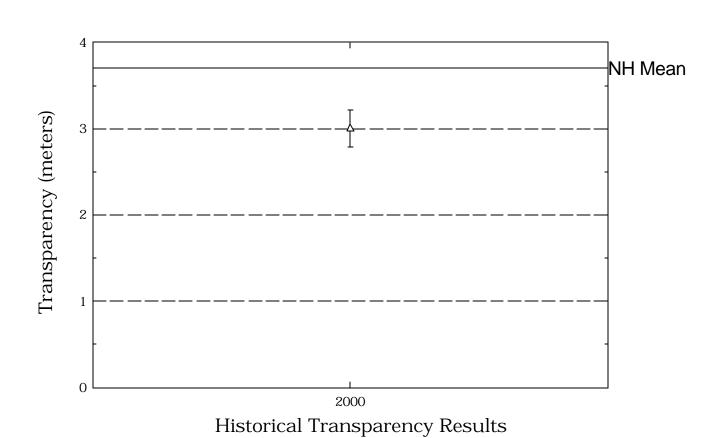
NH Mean

NH Mean

NH Mean

JUNE JULY AUG. SEPT. OCT.

2000 Transparency Results



## Robinson Pond

Figure 3. Monthly and Historical Total Phosphorus Data. 2000 Monthly Results Median Median Total Phosphorus Concentration (ug/L) Upper Water Layer 2000 Monthly Results Median Median 

Lower Water Layer

#### Table 1.

#### ROBINSON POND HUDSON

## Chlorophyll-a results (mg/m $\,$ ) for current year and historical sampling periods.

| Year | Minimum | Maximum | Mean  |  |
|------|---------|---------|-------|--|
|      |         |         |       |  |
| 2000 | 5.26    | 24.49   | 14.68 |  |

#### Table 2.

#### **ROBINSON POND**

#### HUDSON

#### Phytoplankton species and relative percent abundance.

#### Summary for current and historical sampling seasons.

| Date of Sample | Species Observed | Relative %<br>Abundance |
|----------------|------------------|-------------------------|
| 06/09/2000     | CERATIUM         | 44                      |
|                | COELOSPHAERIUM   | 18                      |
|                | MALLOMONAS       | 7                       |
| 07/26/2000     | OSCILLATORIA     | 35                      |
|                | MALLOMONAS       | 23                      |
|                | STAURASTRUM      | 13                      |
| 08/23/2000     | OSCILLATORIA     | 96                      |
|                | FRAGILARIA       | 1                       |
|                | TABELLARIA       | 1                       |
|                |                  |                         |

#### Table 3.

#### ROBINSON POND HUDSON

## Summary of current and historical Secchi Disk transparency results (in meters).

| Year | Minimum | Maximum | Mean |
|------|---------|---------|------|
| 2000 | 2.8     | 3.3     | 3.0  |

## Table 4. ROBINSON POND HUDSON

### pH summary for current and historical sampling seasons. Values in units, listed by station and year.

| Station     | Year | Minimum | Maximum | Mean |
|-------------|------|---------|---------|------|
| EPILIMNION  |      |         |         |      |
|             | 2000 | 6.88    | 7.16    | 7.01 |
| HYPOLIMNION |      |         |         |      |
| METALIMNION | 2000 | 6.32    | 6.74    | 6.51 |
|             | 2000 | 6.42    | 6.66    | 6.51 |
| STATION 1   |      |         |         |      |
| CTEATIVON A | 2000 | 5.79    | 6.97    | 6.06 |
| STATION 2   | 2000 | 0.00    | 7.17    | 7.15 |
| STATION 3   | 2000 | 0.00    | 7.17    | 7.10 |
|             | 2000 | 6.06    | 6.18    | 6.12 |
| STATION 4   |      |         |         |      |
| STATION 5   | 2000 | 6.13    | 6.72    | 6.33 |
|             | 2000 | 6.36    | 6.86    | 6.55 |
| STATION 6   |      |         |         |      |
|             | 2000 | 6.54    | 6.89    | 6.75 |

#### Table 4.

#### ROBINSON POND HUDSON

### pH summary for current and historical sampling seasons. Values in units, listed by station and year.

| Station   | Year | Minimum | Maximum | Mean |
|-----------|------|---------|---------|------|
| STATION 7 |      |         |         |      |
|           | 2000 | 6.80    | 7.06    | 6.91 |
| STATION 8 |      |         |         |      |
|           | 2000 | 6.37    | 6.74    | 6.54 |

#### Table 5.

#### ROBINSON POND

#### HUDSON

## Summary of current and historical Acid Neutralizing Capacity. Values expressed in mg/L as CaCO .

#### **Epilimnetic Values**

| Year | Minimum | Maximum | Mean  |
|------|---------|---------|-------|
| 2000 | 11.10   | 13.10   | 12.08 |

#### Table 6.

#### ROBINSON POND HUDSON

## Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

| 169.5 |
|-------|
| 181.9 |
|       |
| 174.2 |
| 202.2 |
| 286.6 |
| 231.4 |
|       |
| 64.5  |
| 212.7 |
|       |
| 155.8 |
| 168.1 |
|       |
| 168.4 |
| 165.9 |
|       |

#### Table 8.

#### ROBINSON POND HUDSON

### Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

| Station          | Year | Minimum | Maximum | Mean |
|------------------|------|---------|---------|------|
| EPILIMNION       |      |         |         |      |
|                  | 2000 | 10      | 13      | 12   |
| HYPOLIMNION      |      |         |         |      |
| ACTEAL IN DAILON | 2000 | 17      | 110     | 41   |
| METALIMNION      | 2000 | 9       | 86      | 42   |
| STATION 1        |      |         |         |      |
|                  | 2000 | 18      | 31      | 24   |
| STATION 2        |      |         |         |      |
|                  | 2000 | 7       | 27      | 16   |
| STATION 3        | 2000 | 21      | 28      | 24   |
| STATION 4        |      |         |         |      |
|                  | 2000 | 16      | 53      | 34   |
| STATION 5        |      |         |         |      |
|                  | 2000 | 16      | 209     | 83   |
| STATION 6        | 2000 | 18      | 100     | 49   |
| STATION 7        | 2000 | 10      | 100     | 10   |
|                  | 2000 | 8       | 16      | 12   |
| STATION 8        |      |         |         |      |
|                  | 2000 | 7       | 12      | 9    |

## Table 9. ROBINSON POND HUDSON

#### Current year dissolved oxygen and temperature data.

| Depth (meters) | Temperature (celsius) | Dissolved Oxygen (mg/L) | Saturation |
|----------------|-----------------------|-------------------------|------------|
|                |                       | May 24, 2000            |            |
| 0.1            | 18.2                  | 10.9                    | 113.0      |
| 1.0            | 17.0                  | 10.8                    | 110.0      |
| 2.0            | 17.2                  | 10.5                    | 109.3      |
| 3.0            | 16.7                  | 9.6                     | 99.1       |
| 4.0            | 14.0                  | 6.3                     | 60.7       |
| 5.0            | 11.6                  | 4.3                     | 39.8       |
| 6.0            | 10.6                  | 2.7                     | 24.6       |
| 7.0            | 10.3                  | 2.1                     | 18.3       |
| 8.5            | 10.0                  | 0.5                     | 4.6        |
|                |                       | June 9, 2000            |            |
| 0.1            | 18.5                  | 7.4                     | 79.0       |
| 1.0            | 18.2                  | 7.5                     | 79.0       |
| 2.0            | 17.7                  | 7.3                     | 76.4       |
| 3.0            | 17.1                  | 6.8                     | 70.6       |
| 4.0            | 15.0                  | 4.9                     | 48.4       |
| 5.0            | 12.2                  | 2.1                     | 19.3       |
| 6.0            | 11.1                  | 0.9                     | 8.3        |
| 7.0            | 10.6                  | 0.5                     | 4.1        |
| 8.0            | 10.0                  | 0.2                     | 2.2        |
| 8.5            | 9.9                   | 0.2                     | 1.7        |
|                |                       | June 21, 2000           |            |
| 1.0            | 22.5                  | 7.3                     | 84.6       |
| 2.0            | 22.5                  | 6.8                     | 78.7       |
| 3.0            | 18.8                  | 5.2                     | 55.4       |
| 4.0            | 15.5                  | 3.0                     | 29.7       |
| 5.0            | 13.2                  | 1.2                     | 11.1       |
| 6.0            | 11.7                  | 0.6                     | 5.3        |
| 7.0            | 10.7                  | 0.5                     | 4.3        |

## Table 9. ROBINSON POND HUDSON

#### Current year dissolved oxygen and temperature data.

| Depth<br>(meters) | Temperature (celsius) | Dissolved Oxygen (mg/L) | Saturation (%) |
|-------------------|-----------------------|-------------------------|----------------|
|                   |                       | June 21, 2000           |                |
| 8.0               | 10.2                  | 0.4                     | 3.5            |
| 9.0               | 10.1                  | 0.3                     | 2.8            |
|                   |                       | July 26, 2000           |                |
| 1.0               | 24.0                  | 7.3                     | 87.1           |
| 2.0               | 23.9                  | 7.2                     | 85.8           |
| 3.0               | 22.4                  | 4.1                     | 46.7           |
| 4.0               | 18.9                  | 1.1                     | 11.6           |
| 5.0               | 14.0                  | 0.5                     | 5.1            |
| 6.0               | 11.9                  | 0.4                     | 4.1            |
| 7.0               | 11.0                  | 0.5                     | 4.1            |
| 8.0               | 10.5                  | 0.4                     | 3.8            |
| 9.0               | 10.7                  | 0.4                     | 3.4            |
|                   |                       | August 23, 2000         |                |
| 1.0               | 21.9                  | 5.7                     | 64.7           |
| 2.0               | 21.9                  | 5.4                     | 62.1           |
| 3.0               | 21.6                  | 4.9                     | 55.8           |
| 4.0               | 20.3                  | 2.4                     | 26.2           |
| 5.0               | 16.4                  | 3.9                     | 40.2           |
| 6.0               | 13.5                  | 0.4                     | 4.3            |
| 7.0               | 11.9                  | 0.2                     | 2.1            |
| 8.0               | 11.0                  | 0.2                     | 1.4            |
| 9.0               | 11.2                  | 0.1                     | 1.0            |
|                   |                       | September 27, 2000      |                |
| 1.0               | 17.6                  | 5.8                     | 60.7           |
| 2.0               | 17.6                  | 5.6                     | 59.1           |
| 3.0               | 17.6                  | 5.8                     | 60.5           |
| 4.0               | 17.6                  | 5.8                     | 61.1           |
| 5.0               | 17.4                  | 6.3                     | 66.1           |
|                   |                       |                         |                |

## Table 9. ROBINSON POND HUDSON

#### Current year dissolved oxygen and temperature data.

| Depth    | Temperature | Dissolved Oxygen | Saturation |  |
|----------|-------------|------------------|------------|--|
| (meters) | (celsius)   | (mg/L)           | (%)        |  |
|          |             |                  |            |  |
|          | Septe       | ember 27, 2000   |            |  |
| 6.0      | 14.1        | 0.5              | 4.9        |  |
| 7.0      | 12.1        | 0.3              | 2.6        |  |
| 8.0      | 10.9        | 0.3              | 2.3        |  |
| 9.0      | 10.8        | 0.1              | 1.2        |  |

Table 10.

#### ROBINSON POND HUDSON

#### Historic Hypolimnetic dissolved oxygen and temperature data.

| Date               | Depth (meters) | Temperature (celsius) | Dissolved Oxygen (mg/L) | Saturation (%) |
|--------------------|----------------|-----------------------|-------------------------|----------------|
| May 24, 2000       | 8.5            | 10.0                  | 0.5                     | 4.6            |
| June 9, 2000       | 8.5            | 9.9                   | 0.2                     | 1.7            |
| June 21, 2000      | 9.0            | 10.1                  | 0.3                     | 2.8            |
| July 26, 2000      | 9.0            | 10.7                  | 0.4                     | 3.4            |
| August 23, 2000    | 9.0            | 11.2                  | 0.1                     | 1.0            |
| September 27, 2000 | 9.0            | 10.8                  | 0.1                     | 1.2            |

## Table 11. ROBINSON POND HUDSON

### Summary of current year and historic turbidity sampling. Results in NTU's.

| Station     | Year | Minimum | Maximum | Mean |
|-------------|------|---------|---------|------|
| EPILIMNION  |      |         |         |      |
|             | 2000 | 0.3     | 0.5     | 0.4  |
| HYPOLIMNION | 0000 | 4.0     |         |      |
| METALIMNION | 2000 | 1.6     | 26.0    | 7.7  |
|             | 2000 | 0.5     | 8.6     | 3.2  |
| STATION 1   |      |         |         |      |
|             | 2000 | 3.7     | 5.3     | 4.5  |
| STATION 2   | 2000 | 0.0     | 0.7     | 0.4  |
| STATION 3   |      |         |         |      |
|             | 2000 | 2.0     | 3.8     | 2.9  |
| STATION 4   | 2000 | 0.6     | 2.4     | 1.5  |
| STATION 5   | 2000 | 0.0     | ω. τ    | 1.0  |
|             | 2000 | 2.5     | 5.0     | 4.0  |
| STATION 6   |      |         |         |      |
| STATION 7   | 2000 | 0.6     | 3.1     | 1.6  |
|             | 2000 | 0.3     | 0.7     | 0.6  |
| STATION 8   |      |         |         |      |
|             | 2000 | 0.2     | 0.6     | 0.3  |

#### Table 12.

#### ROBINSON POND

#### HUDSON

### Summary of current year bacteria sampling. Results in counts per 100ml.

| Location   | Date    | <b>E. Coli</b><br>See Note Below |
|------------|---------|----------------------------------|
| STATION 10 |         |                                  |
| STATION 11 | June 9  | 9                                |
| STATION II | June 9  | 17                               |
| STATION 1  |         |                                  |
| STATION 2  | June 21 | 4                                |
| SIATION &  | June 21 | 81                               |
| STATION 3  |         |                                  |
| STATION 5  | June 21 | 0                                |
|            | June 21 | 2                                |
| STATION 7  | L 01    | 10                               |
| STATION 8  | June 21 | 10                               |
|            | June 21 | 3                                |
| STATION 9  | June 9  | 12                               |
|            | Julie 3 | 12                               |